

BELLCOMM, INC.

SUBJECT: CSM 101 ΔCDR, Environmental Control
System Review - Case 320

DATE: November 14, 1967

FROM: T. A. Bottomley, Jr.

ABSTRACT

A Delta Critical Design Review of CSM 101 was held at North American Rockwell, Downey, California on October 10-12, 1967.

Several problem areas were discussed by the Environmental Control System working group which deserve further attention. In brief, analyses are needed to:

- a. assess the potential for, and control of, hydrogen accumulation in the water pressurization system,
- b. evaluate the risks of concentrated chlorine solution spillage and adequacy of control of chlorine levels in the potable water,
- c. determine the requirement for post landing integrity of the water glycol subsystem based on toxicity effects of glycol,
- d. determine operational and failure modes which could result in two-phase oxygen flow from cryogenic supplies,
- e. examine the impact of gaseous breakthrough of the water separation plate and feasibility of inflight recharging, and
- f. determine the Criticality I (crew loss) failure modes for the suit circuit when not backed-up by a safe cabin atmosphere.

(NASA-CR-91629) GSM 101 DELTACDR,
ENVIRONMENTAL CONTROL SYSTEM REVIEW
(Bellcomm, Inc.) 4 p

N79-73031

00/54 Unclas
 11035

BELLCOMM, INC.

SUBJECT: CSM 101 ACDR, Environmental Control
System Review - Case 320

DATE: November 14, 1967

FROM: T. A. Bottomley, Jr.

MEMORANDUM FOR FILE

On October 10-12, 1967, a Delta Critical Design Review of CSM 101 was held at North American Rockwell (NAR), Downey, California. The overall results have been summarized in a separate memorandum.*

During the meetings of the Environmental Control System review group a number of potential problem areas were discussed which were not covered in the same context, or were not covered at all, by Review Item Dispositions (RID's) submitted for board review. The reason for concern is because the design (as it is being implemented in these areas) does not appear to be supported by adequate analyses or tests.

The Manufacturing Change Requests (MCR's) in which the potential problems exist are as follows:

1. MCR 3873 - H₂ Concentration in Potable and Waste Water

Additional analyses and testing are recommended to get a better assessment of the amount of hydrogen from the fuel cells which may accumulate in the pressurization system of the water tanks.

Pratt and Whitney, NAR and MSC are not in agreement that there is a problem. If the currently planned continuous O₂ purge were not required, a savings of approximately 18 lbs. of oxygen could be realized during a 10.6 day mission.

*CSM 101 ACDR Summary Report, Case 320, M/F by P. F. Sennewald dated 10/18/67.

2. MCR 3775 - Sterilization of Drinking Water

Further testing is needed to provide assurance that spillage of the concentrated chlorine solution will not occur and that required chlorine levels can be maintained.

Chlorine is injected into the potable water tank by means of an ampoule-loaded syringe. The ampoules for the syringe are plastic bags of concentrated (1,000 to 3,000 ppm) sodium hypochlorate solution. While design definition is essentially completed, no vender for the ampoules has been selected. In addition, both NAR and AiResearch are now recommending a "silver ion" generator be used, in place of chlorination, to preclude bacterial growth.

3. MCR 1586 - Water Glycol Quick Disconnects

MSC questioned whether postlanding structural integrity of the water glycol loop should not be demonstrated for the IMU as it is for the ECS. It is understood that dummy IMU's have been used during impact tests.

NAR replied that no requirement exists for either system to maintain structural integrity after landing. In addition, it was reported that the NAR medical advisors do not consider glycol toxic under sea level conditions due to its low vapor pressure.

A review of the literature indicates a wide difference of opinion on the toxicity effects of glycol following skin contact and absorption. Opinions range from little or no absorption and mild irritation to ready penetration followed by metabolic formation of oxalic acid and precipitation of calcium oxalate crystals in the kidney. The question of skin sensitivity and effects requires resolution.

4. MCR 3777 - Rapid CM Repressurization Capability

A RID was submitted and approved requesting an analysis to determine if two-phase oxygen flow from cryogenic supplies will occur during the surge

tank and supplemental tank refill after cabin repressurization. The analysis should consider both the nominal case and failure of the primary glycol loop (i.e., with operation on the secondary glycol loop in which case no heat is supplied to inflowing oxygen).

5. MCR 3815 - Use of Air-on-the-Pad

Two areas of concerns exist here:

A. A study and tests are needed to determine if the high oxygen flow rate required to maintain a positive suit-to-cabin ΔP will dry out the water separator plate during prelaunch or in flight.

A preliminary analysis by NAR indicates that failure to keep the sintered water separator plate wet will permit gaseous oxygen to enter the water recovery subsystem. This failure mode will result in a high humidity condition which is considered to be cause for abort. In addition, it will result in reduced cyclic accumulator and water boiler efficiencies.

It was suggested by the author that a simple fix appeared feasible which would permit recharging the separator plate in flight. The modification would require making the ground servicing port to the separator plate reservoir compatible with the nozzle of the water gun.

B. A failure and failure effects analysis is required to determine the Criticality I (crew loss) single-point failure modes which will exist when the suit circuit is not backed up by a survivable cabin atmosphere.

2031-TAB-sjh


T. A. Bottomley, Jr.